metry, his real aim is declared by Klein—and the declaration can find ample support from his memoirs and his treatises—to have been the achievement of progress in the theory of differential equations. It was for this purpose that he developed his theory of transformations, and worked at it from his earliest productive days to his latest with a consistent tenacity characteristic alike of the nature and the strength of his mathematical genius.

The death of Sophus Lie removes from the rank of active workers in pure mathematics one of the most conspicuous, independent, and original minds of his generation. A. R. F.

NOTES.

THE Joint Committee of the Royal Society and the Royal Geographical Society, appointed to promote the project of an Antarctic Expedition, have made recommendations to the Royal Society Council and to the Council of the British Association, in pursuance of which the Treasurer of the Royal Society has applied on behalf of the Council to the Government Grant Committee for 1000*l.*, and the Council of the British Association has resolved to recommend to the General Committee to contribute a like amount towards the expenses of the proposed undertaking.

THE Croonian Lecture will be given at the Royal Society on Thursday next, March 16, by Dr. Burdon-Sanderson, F.R.S. Subject—"The Electrical Concomitants of Motion in Animals and Plants."

A MEETING of the committee of the Liverpool Association of Foreign Consuls was held on February 27, in the office of the Brazilian Consulate, for the purpose of taking into consideration the Liverpool School of Tropical Diseases and its recognition by the Governments represented. The company having been addressed by Mr. Alfred L. Jones, as representing the Congo Free State, and by Mr. Ehrenberg, consul for Sweden and Norway, it was agreed to hold a general meeting of the consuls on March 9, so that they might be better able to inform their Governments on the subject. Prof. Boyce then explained that four courses of two months each would be given to qualified men every year. Liverpool, he thought, was the best possible place in which to establish such a school, as they had examples of the diseases in question brought from all the tropical regions of the world. Besides instructing qualified medical men who would have appointments on shipboard, or intended to practise in tropical countries, they would admit missionaries to the classes, and would also train black women as nurses.

BEING invited to take part in the opening of the new School of Tropical Diseases at Liverpool, Prof. Koch has written regretting his inability to be present, and saying: "Permit me to express my sympathy with the new institution and to offer my best wishes for the success of your grand and useful undertaking. I certainly hope to be able later to have the opportunity to personally visit the new institution." In another letter the professor says: "Blackwater fever is the most important disease in West Africa, but one which, I am convinced, it will be easy to prevent when the course and character of the disease become more familiar. Up to the present we have received, with very few exceptions, very satisfactory accounts. Those practitioners in the tropics who have written, give nothing more than anecdotary reports of no scientific value whatever. It will be one of the most important duties of the new school to give medical men going out to the tropics a clear idea of the disease, and to impress on them how to make and collect scientific and useful observations. You in Liverpool have opportunities of seeing cases; even here in Germany I have seen five cases (two in Berlin) during the last half-year in persons who have returned from the tropics."

WE are informed by the Secretary of the Institution of Electrical Engineers that, as many members and others failed to gain admission to the meeting on March 2, Mr. Marconi has promised, at the request of the Council, to repeat his lecture on wireless telegraphy, with demonstration, on Thursday, March 16, in the theatre of the Examination Hall, Victoria Embankment. Up to 7.45 p.m. admission will be only by tickets, to be obtained by members on application to the Secretary.

THE Royal Institution Friday evening discourse on March 10 is on "Measuring Extreme Temperatures," by Prof. H. L. Callendar, F.R.S.; that on March 17 is on "The Electric Fish of the Nile," by Prof. Francis Gotch, F.R.S.; and that on March 24 on "Transparency and Opacity," by Lord Rayleigh, F.R.S.

THE new laboratories in connection with the Middlesex Hospital Medical School are, we hear, now completed. They are equipped with all the best modern appliances for the purpose of instruction and original research. An inaugural conversazione will be held on the evening of Wednesday, March 15, in the new buildings, when many objects of interest will be exhibited.

THE President of the Board of Trade has consented to receive a deputation of representatives from the Decimal Association, Chambers of Commerce, Educational Institutions, and Trades Unions on March 22, when the Government will be urged to make compulsory the use of the metric weights and measures after a period of two years, January 1, 1901, having been suggested as a suitable date for the introduction of the new system.

THE Fothergillian gold medal for 1899 has, on the recommendation of a special committee of the Medical Society of London, been awarded to Dr. S. Monckton Copeman "in recognition of his researches on the preservative effects of glycerine upon vaccine lymph and of the benefits in a practical sense that have arisen therefrom."

Science announces that the House Committee on Appropriations has recommended an increase of 4200 dollars in the annual appropriation for scientific work of the United States Fish Commission. This increase is made after an examination of the practical results that have attended the lines of scientific research carried on during the past year.

A BILL has been introduced into the New York Assembly appropriating 30,000 dollars to continue the promotion of the sugar beet industry. Of this amount 2500 dollars are devoted to making experiments by the Commissioner of Agriculture.

IT is reported that a committee has been appointed by the Council of the Institution of Electrical Engineers to inquire into the future of electrical engineering in the domain of telephony in this country.

ON November 17, 1897, the sum of twenty thousand dollars was given to the National Academy of Sciences, as trustee, to establish a fund to be known as the Benjamin Apthorp Gould Fund, in memory of the father of the donor, Miss Alice Bache Gould, the income to be used to assist the prosecution of researches in astronomy. A sufficient available income has now accrued from the fund to warrant beginning its distribution, and the Directors are prepared to receive and consider applications for appropriations. In accordance with the wish of the donor, work in the astronomy of precision shall, in all cases, be given the preference over any work in astrophysics. The fund is intended for the advancement and not for the diffusion of scientific knowledge, and is to be used to defray the actual expenses of investigation, rather than for the personal support of the investigator during the time of his researches, without absolutely excluding the latter use under the most exceptional circumstances. Although intended primarily to assist American investigators, foreign workers may occasionally receive benefit from the fund. Application for appropriations from the income of the fund should be made by letter to the Directors, at 16 Craigie Street, Cambridge, Mass., U.S.A., stating the amount desired, the nature of the proposed investigation, and the manner in which the appropriation is to be expended.

THE National Geographic Society of America offers two prizes of 150 dollars and 75 dollars respectively for the best essays on Norse discoveries in America. Essays submitted in competition must be type-written in the English language, not exceed 6000 words in length, be signed by a pseudonym, and received not later than December 31 of the present year.

PLANS have been made for the erection of a State meteorological station on the summit of Schneekope, one of the Riesengebirge, Silesia, which is 1605 metres in height.

Science states that in the Museum of the Brooklyn Institute a department will be established in which natural history and technology will be exhibited in a manner that will interest and instruct children. This, according to our contemporary, is a new departure for America.

THE *Times* correspondent in Zürich writes that a Volta commemoration is to be held in May next at Como, where the great electrician was born, and where he died in 1827. The *fêtes* at Como are to celebrate the centenary of Volta's discovery of the electric pile, in honour of which event an exhibition of inventions in electricity will be opened on May 14, the town contributing some 500,000 francs to the preliminary expenses. Como has always been proud of its greatest citizen, and Volta's memorials are carefully preserved in its Museo Civico, where can be seen his first electric pile, many of his scientific instruments, an electric pistol, and an electric lamp of his invention, besides many of his manuscripts, sketches, and designs. Exhibits are announced from all parts of Europe and America, and a congress of electricians and telegraphists will be held at the same time. In connection with the Volta commemoration an exhibition of Italian silk industries will be opened simultaneously with the electric exhibition. The exhibition buildings face the lake, on which the latest inventions in electric boats and launches will form a conspicuous feature of the *fêtes*. Volta's electric pile was first described in England in a letter to Sir J. Banks, then president of the Royal Society. This letter is dated March 1, 1800, and was read before the Society on June 26 of the same year.

ACCORDING to *Engineering* the Belgian Society of Electricians is organising an electrical exhibition to be held at Brussels next June, in the Central Telephone Building, Rue de la Paille. The scope of this exhibition is a small one, as it is intended to illustrate only the domestic applications of electricity, but it promises to be one of great interest. The contents will be divided into two sections, and fourteen classes. The first section comprises four classes as follows: (1) Lighting. (2) Electric heating. (3) Power. (4) Batteries and accumulators, including every variety of primary and secondary cells. The second section includes ten classes. (5) Telephones and telegraphs, especially adapted for private service. (6) Safety and control apparatus. (7) Clocks, chronographs, and other similar instruments. (8) Hygiene. (9) Medical electricity. (10) Miscellaneous, such as lightning conductors, luminous signs, the seasoning of wines and alcohols electrically. (11) Music. (12) Electric locks and other safety devices. (13) Electric toys and jewellery. (14) The combination of furniture and decoration with electrical appliances. No generators will be admitted for exhibition, but current will be supplied gratuitously to all exhibitors. A charge for space will be made, varying according to the location allotted, and whether isolated or grouped. Further information respecting the exhibition can be obtained by application to the Secretary of the Executive Committee, 18 Rue Melsens, Brussels.

THE tenth meeting of the International Congress of Hygiene and Demography will be held in Paris in August 1900. The division of Hygiene will comprise seven sections, of which the following is a list: (1) Microbiology and parasitology applied to hygiene, in which the questions to be discussed are the measurement of the activity of serums; the prophylaxis and preventive treatment of diphtheria; meat poisoning, its causes and the means of its prevention; pathogenic microbes in soil and water (cholera, typhoid fever, and other diseases); the part played by water and by vegetables in the etiology of intestinal helminthiasis. (2) Chemical and veterinary sciences applied to hygiene; alimentary hygiene, in which the questions to be discussed are tinned provisions and the means of preventing accidents; unification of international control; the establishment of a general and uniform system of inspection of slaughter-houses, &c. (3) Engineering and architecture applied to hygiene, in which the question to be discussed is the protection of water supplies. (4) Personal hygiene, in which the question to be discussed is contagious patients from the hospital point of view. (5) Industrial and professional hygiene. (6) Military, naval, and colonial hygiene, in which the question to be discussed is the means of ensuring the purity of water from the point of view of colonial hygiene. (7) General and international hygiene (prophylaxis of communicable diseases; sanitary administration and legislation), in which the questions to be discussed are the prophylaxis of tuberculosis in regard to individuals, families, &c.; the compulsory notification of communicable diseases, its necessary consequences (isolation, disinfection) and its results in different countries; the prophylaxis of syphilis; and the international prophylaxis of yellow fever.

ON Sunday morning, at about twenty minutes past two, a disastrous explosion occurred at the Lagouban Naval Magazine, which is situated on a hillside about two and a quarter miles from Toulon. It is said that the magazine contained 50,000 kilogrammes (or nearly fifty tons) of black powder; and, as every one agrees that only one report was heard, the whole must have been blown up simultaneously. Many of the effects of the explosion are of interest. For nearly two miles round, the country has been swept almost bare. Houses are razed to the ground, trees are overturned, or bent and distorted to the most extraordinary shapes, the fields are devastated and covered with stones and fine impalpable black dust. One stone, weighing nearly fifty kilogrammes, fell in the suburb of Pont de Las. Windows were shattered and doors battered in at St. Jean de Var, five miles from Lagouban. The explosion was heard and felt at Nice (84 miles), where it was at first supposed by some to be a slight earthquake; and it is also said to have been felt across the frontier at Ventimiglia, which is at a distance of about 98 miles.

AT a meeting of the Society of Arts, on the 17th ult., the Rev. J. M. Bacon read a valuable paper on the balloon as an instrument of scientific research. The author reviewed the subject from the time of the ascents organised by the Russian Academy at the beginning of this century, until the recent researches under the auspices of the international organisation now in active progress in various countries, and including the experiments with unmanned balloons and with kites. He very properly attached much importance to the work carried on in 1852, under the auspices of the British Association, by Mr. J. Welsh, of the Kew Observatory, and by Mr. J. Glaisher ten years later. The primary objects of the exhaustive researches of the latter were to determine the temperature and hygrometric condition of the air below the clouds, in them and above them. These ascents clearly proved that the decrease of temperature with elevation is far from constant, and that during the midnight hours there is generally an increase of several degrees. The experiments with unmanned balloons, which have ascended far beyond the limits of human endurance, have brought down readings showing altitudes and temperatures never dreamed of. In those conducted at Berlin an altitude of upwards of 60,000 feet has been reached, and a temperature of −88° was recorded; while a temperature of 6° lower has been recorded in a similar balloon despatched from Paris. The author draws attention to important results obtained with regard to the motions of the atmosphere, and the transmission of sound waves.

At the recently held annual meeting of the Washington Academy of Sciences, Prof. Charles D. Walcott was elected president for the ensuing year. A course of popular lectures on scientific subjects has been arranged for delivery during March and April, and a number of demonstrations will also be given on topics of special interest. The Academy has decided to publish its proceedings. The "brochure" plan has been adopted; each separate publication will have its own pagination as well as that of the volume, and be dated with the actual date of delivery to members. A welcome donation to the Academy was recently made by Mrs. G. Hubbard, of the value of 1000 dollars, as a token of her desire to aid in the advancement of science and the union of scientific interests in Washington.

It is stated in *Science* that Dr. Charles Mohr, special agent of the Forestry Division of the United States Department of Agriculture, has recently presented to the Museum of Pharmacognosy of the University of Michigan some interesting and valuable specimens. They consist of a section of a pine-tree trunk, showing the American method of boxing and bleeding long-leafed pines for turpentine, and of samples of the twenty different turpentine products manufactured in the South. The various stages of the manufacture of turpentine are, it is said, well illustrated by these specimens.

The *Geographical Journal* for March, speaking of the German Deep-Sea Expedition, says that a letter from Prof. Chun, the leader of the expedition, dated January 20, has reached Sir John Murray, from which it appears that the voyage of the *Valdivia* down the Atlantic to the edge of the Antarctic ice, and thence through the Indian Ocean, has been most successful, the soundings alone serving to fill an important gap on the charts, and showing that the average depth of the Southern Ocean must be considerably greater than has been supposed. The *Journal* says that Sir John Murray considers that the success of the German investigators in attaining so high a southerly latitude, as is mentioned in the letter, in a vessel not protected for ice-navigation is very remarkable, and that it augurs well for the prospects of a scientific Antarctic expedition. Prof. Chun's communication, which is printed in full in the *Journal*, states that Dr. Bachmann, the surgeon to the expedition, died in the Indian Ocean, but that all the other members of the party were well.

Sir Charles Todd has communicated to the *South Australian Register*, of January 14, a review of the weather of South Australia during the year 1898. He states that, although owing to dry weather at the beginning and end of the year, as well as in September, when the failure of rain was fatal to the harvest in many parts of the Upper North, more rain fell over the settled districts generally than during the two previous years. June was the wettest June in the north on record at all stations. As regards temperature, it was below the average during the first five months of the year in the northern and central parts, and above the average during the rest of the year; while in the extreme south it was generally warmer than the average all through the year. Altogether the harvest season has turned out a very fair one: a great improvement on the past two or three years.

In the *Meteorologische Zeitschrift* for January, Dr. J. Hann has contributed a short paper on the climate of the Klondike district, collated from observations at present available. The following are the values for temperature at Dawson City during four months of January: means of the daily extremes (minima and maxima) −26°·1, −17°·0; means of the monthly extremes −54°·6, 12°·7; the absolute extremes are −67°·9, 21°·9. For July only one month is available: the mean daily extremes are 44°·4 and 68°·9, and the mean monthly extremes are 32°·9 and 81°·0. These values are not out of the way for a continental climate in such a high latitude (64° 5′ N.); they do not compare with the low winter and high summer temperatures in the same latitude of East Siberia.

A description of the Vertebrate remains from the Port Kennedy Bone Deposit was the last scientific work of the late Prof. E. D. Cope, and it has now been published in the *Journal* of the Academy of Natural Sciences of Philadelphia (vol. xi. part 2, 1899). The MS. has been printed just as it left the hands of the author, and such of the fossils as it was necessary to figure have been illustrated in four plates by a photographic process. Curiously enough no other fissure or bone-cave has yielded such a large number of species as this cave or fissure at Port Kennedy, which is situated in Upper Merion Township, Montgomery County, Pennsylvania. So long ago as 1871 its ossiferous nature was discovered by workmen engaged in quarrying the Cambrian limestone in which the fissure occurs, and many of the fossil remains were then identified by Prof. Cope. The palæontological interest of the locality was, however, for more than twenty years lost sight of, until Mr. H. M. Mercer and others engaged in careful excavations, and obtained materials for the full report which is now issued. The assemblage is a remarkable one. Tiny Mammalia such as shrews, and voles occur alongside of the mastodon and giant sloth. Remains of horse, tapir, peccary, and porcupine occur together with machærodus, lynx, wolverine, wolf, and bear. Semi-terrestrial forms of tortoise, snake, and beaver are found with the hare, squirrel, and jumping mouse. The majority of the forms are not in any sense cave-dwellers, nor could they well have been dragged there by carnivorous species. The bones are neither gnawed nor water-worn. At the same time, two bones have been rarely found in their normal relations to the skeleton. As stated in a previous report (*Proc.* Acad. Nat. Sc. Philad. for 1895, p. 450), Prof. Cope believed that the larger animals fell into the fissure at intervals during a long period, while many of the smaller ones may have entered it by channels now filled with débris; and Prof. A. Heilprin (p. 451) thought that the large number of extinct or Neotropical forms, indicated more nearly a Pliocene than a Post-Pliocene (or Pleistocene) fauna—at all events a fauna which preceded the glacial epoch.

The additions to the Zoological Society's Gardens during the past week include a Smooth-headed Capuchin (*Cebus monachus*, ♂) from South-east Brazil, presented by Mrs. Cecil Popham; a Sooty Mangabey (*Cercocebus fuliginosus*, ♀) from West Africa, presented by Lieut. B. Horsburgh, A.S.C.; a

Black-backed Jackal (*Canis mesomelas*) from South Africa, presented by Mr. R. C. Cooper; a Wild Cat (*Felis catus*) from Scotland, presented by Mr. Claude Alexander; a Silver Pheasant (*Euplocamus nycthemerus*, ♂) from China, presented by Mr. W. McNaughton Love; two Thars (*Hemitragus jemlaicus*, ♂ ♀) from the Himalayas; a Long-billed Butcher Crow (*Cracticus destructor*) from New Holland; a Laughing Kingfisher (*Dacelo gigantea*) from Australia, deposited; a Thick-tailed Opossum (*Didelphys crassicaudata*, ♀) from La Plata, a White-eyebrowed Guan (*Penelope superciliaris*) from South-east Brazil, a Little Guan (*Ortalis motmot*) from Guiana, three Elliot's Pheasants (*Phasianus ellioti*, ♂ ♀ ♀) from China, purchased.

OUR ASTRONOMICAL COLUMN.

COMET 1899 *a* (SWIFT).—Three telegrams have been received from Kiel announcing the discovery of the first new comet of this year. Two observations of it appear to have been made, the respective positions being as follows:—

1899.		R.A. h. m. s.		Decl. ° ′ ″
March 3	...	3 45 0	...	−29 0 0
4	...	3 48 0	...	−27 7 0
6	...	3 37 8	...	−24 8 32

It is described as being bright enough to be seen with the naked eye, and having a slow movement.

The comet should be looked for immediately after sunset in the south-eastern sky. At present it is about 12° due south of the 2nd magnitude star γ Eridani, passing the meridian about 5.30 p.m. As a guide to its position, it is nearly on the line joining α and β Orionis, about twice as far from the latter as these two stars are apart.

TUTTLE'S COMET.—Another telegram from Kiel communicates an ephemeris of this comet, which has been computed by J. Rahts from data obtained in 1885.

Ephemeris for 12h. M.T. Berlin.

1890.		R.A. h. m. s.		Decl. ° ′		Br.
March 5	...	0 59 58	...	+33 36·2	...	
7	...	1 7 23	...	33 17·8	...	0·62
9	...	14 51	...	32 58·5	...	
11	...	22 21	...	32 38·2	...	0·66
13	...	29 52	...	32 16·9	...	
15	...	37 25	...	31 54·4	...	0·70
17	...	45 0	...	31 30·8	...	
19	...	1 52 35	...	31 6·2	...	0·75
21	...	2 0 10	...	30 40·0	...	
23	...	7 47	...	30 12·8	...	0·80
25	...	15 23	...	29 44·2	...	
27	...	2 23 0	...	+29 14·4	...	0·86

The brightness, in terms of its intensity in 1885, August 10, this being unity. The above positions extend from about half-way between α and β Andromedæ to the centre of the constellation Triangulum. It should be looked for soon after sunset.

As we go to press, a telegram has been received announcing the observation by Herr Wolf of a comet sufficiently near the position given in the above ephemeris to suggest its being the same. The coordinates are as follows:—

1899. d. h.		R.A. h. m. s.		Decl. ° ′ ″
March 5 11.5	...	1 16 0	...	+31 38 0

No information is given concerning the brightness of the comet.

LOWELL OBSERVATORY.—In "Popular Astronomy," vol. vii. p. 74, Mr. A. E. Douglass gives a *résumé* of the planetary work which has been done at the Lowell Observatory, Flagstaff, Arizona, during the past four years. Observations of Mercury, by Messrs. Lowell and Drew, confirmed Schiaparelli's result that the planet rotates once during its revolution round the sun. Lines of various widths and dark patches were seen. Venus was examined by the same observers, and also found to continuously present the same aspect to the sun. The markings are faint but certain with good seeing. The prevailing straw-colour seen is ascribed to the presence of an atmosphere. Mars has received special attention, Mr. Lowell having found a number of new canals and lakes. Much time was spent in tracing the seasonal changes on the planet. The white South Polar cap was observed to diminish as the equinox approached, and at the same time a dark line formed round it, the grey tint of the south temperate zone assuming a distinct bluish green, strongly suggestive of growing vegetation. Later this zone turned brown, and finally to a slowly lightening yellow.

The frequently observed projections on the terminator are ascribed by Prof. W. H. Pickering to clouds in the Martian atmospheres. These clouds appear to only form during the planet's night; and this, if true, helps to explain the high mean temperature of the planet as was suggested, in 1892, by Prof. Pickering.

Vesta is found to have a polar compression of $\frac{1}{10}$, the major diameter being almost in the direction of its orbit. The markings detected indicate a direct rotation in less than thirty hours. Jupiter's satellites have been carefully observed to compare with the results of Prof. Pickering at Arequipa in 1892. The period of rotation of Satellite I. is found to be 12h. 24·0m.; its ellipticity is perceptibly greater than in 1892, and its mean diameter slightly less. Detail was seen in Satellite II., showing rotation, but no time deduced. Satellites III. and IV. have direct rotation, always presenting the same face to Jupiter.

The paper concludes with a proposal to establish a systematic notation for further expressing the observing conditions under which astronomical work is carried on. The author gives a "scale of seeing," based on the appearance of the stellar image in a lens of six inches aperture.

THE NORTHERN POLYTECHNIC, HOLLOWAY.

TO form a correct estimate of the existing provisions for the education of the millions who are crowded into the metropolitan area, it is essential to give an adequate consideration to the work being done by the fifteen separate institutions and branches which are included under the London polytechnics. The buildings in which this work is being accomplished may be estimated to have cost at least half a million sterling in capital outlay, and to be expending about 130,000*l.* annually upon some 50,000 students of the multitude of subjects for which provision is made. The receipts from fees and other miscellaneous sources do not exceed 30,000*l.*, leaving 100,000*l.* to be met from other funds. Private subscriptions probably amount to 10,000*l.* The contributions of the City Companies (principally the Drapers', Goldsmiths', and Skinners') provide some 20,000*l.* more. But at least 70,000*l.*, or about two-thirds of the net cost of the work, is drawn from public funds. The grants of the Science and Art Department may be estimated at 10,000*l.* The Central Governing Body of the City Parochial Charities contributes altogether about 30,000*l.*, and the London County Council, through its Technical Education Board, supplies 30,000*l.*, definitely allocated to the part of the work falling within the statutory definition of technical instruction.

"Each polytechnic institute is an independent organisation, unique in its deliberate combination of social intercourse, recreation and instruction. It is not subject to control by any Government department or other authority, and free, within the limits of its own trust-deed or other constitutional document, to move in whatever direction may be determined on by its governing body." They are, however, with one exception, based upon schemes of the Charity Commission and subject, to a certain extent, to ultimate control by that body. They necessarily defer to any suggestions made by the trustees of the City Parochial Charities, since they, all but two, receive large sums of money from them. The Technical Education Board of the London County Council exerts a very real authority over the educational work carried on in these institutions; for all of them, with two exceptions, are in a great measure dependent upon the large subsidies from this source.

It must not be lost sight of that "in every polytechnic institute the club rooms for men and women respectively, the concerts and entertainments of various sorts, the popular lectures and excursions, form a leading feature. Well-equipped gymnasia and playing-fields, billiards and other games, reading-rooms and lending libraries, as well as mutual societies of all kinds (debating, essay, Shakespeare, swimming, rambling, cycling,